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AUTHOR Goodman, H. J. A.
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ABSTRACT

This discussion of the design, development, and operation of information systems functioning at the national or international level focuses on some of the current interests and concerns of those networks designed to facilitate the sharing or exchange of particular types of nonprint media (NPM) materials. Three categories of NPM materials/resources of "documents" include those which contain information about informative/informational resources/materials which are themselves in NPM formats, those which themselves comprise informative NPM materials, and those which encompass both types. Two basic assumptions are made: the first is that electronic nonprint material information systems will be increasingly necessary for the fast, accurate, and efficient control of the complicated and interdependent processes of our high technology civilization, and the second is that national and international networks will henceforth continuously have a considerable influence on regional, state, and local information systems, as well as on the whole realm of information science. (Author/RAO)

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THE DEVELOPMENT OF NATIONAL AND INTERNATIONAL INFORMATION SYSTEMS AND NETWORKS INVOLVING COMBINATIONS OF PRINT AND NON-PRINT MEDIA

by

H.J.A. Goodman

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THE DEVELOPMENT OF NATIONAL AND INTERNATIONAL INFORMATION SYSTEMS AND NETWORKS INVOLVING COMBINATIONS OF PRINT AND NON-PRINT MEDIA

H.J.A. Goodman

University of Calgary

INTRODUCTION

This paper addresses an aspect of information science which has in recent years elicited considerable intense activity on the part of print and non-print media (NPM) professionals alike, i.e., that species of information system designated as "networks". More specifically, the paper treats some of the current major areas of interest and concern (largely thus far confined to NPM specialists) which are inherent in those information systems or networks designed to facilitate the sharing or exchange of particular types of "NPM-involved" materials/resources or "documents". The categories of NPM-involved items to be dealt with include those which contain information about informative/informational resources/materials which are recorded or couched in NPM formats; those which themselves comprise informative NPM materials; and those which encompass both types. All are deemed to be NPM-involved without regard to whether the information in question is conveyed/communicated/transmitted via NPM, or whether it is eventually presented/displayed in NPM or other formats. Also included within the groups of networks or systems herein deemed to be NPM in nature are those which are connected, in varying degrees and in various combinations, with both the print medium and the non-print media. And within the above-designated parameters, this paper deals, almost exclusively, with the design, development, and operation of those systems/networks which, whether being planned or already operational, are intended to function primarily at the national and/or the international levels of activity.

Terminology

In view of the current state of disarray in which the terminology in the information/communication field finds itself, it would probably be well to intimate the particular connotation/denotation attached to the most frequently used technical terms employed within this paper.

The term "network" may be defined either loosely and more generally, or formally and more restrictedly. Its usage here is

more of the former, rather than the latter type, and is intended to encompass all but the very loosest usages of the term. Networks are herein deemed to be more or less well-organized entities/systems, such as cooperative bodies, consortia, government departments, educational agencies, or industrial concerns, which have branch offices, etc., and which, by means of either formal or informal arrangements among the members or parts (persons and/or institutions, etc.), are designed to make possible, as well as to facilitate, the actual engagement of the participants in patterns of one or more types of resource sharing or exchanges. In NPM networks, the resources shared or exchanged are likely to be NPM information, materials, services, or some combination thereof and the interactions involved in the sharing process could be motivated by functional, financial, or other reasons. To comprise a network, the interchanges in question would necessarily involve two or more physically/geographically separated locations.

The information network types considered here embrace the entire range, from highly structured arrangements, which involve a contractual agreement among the members, a fee schedule, and even a central administrative staff to coordinate the conjoint activities, to informal on-going mutual pooling of experiences, and to systems which operate effectively without an identifiable common budget. (These systems would probably be able to so operate because their members carry out their cooperative responsibilities in addition to, or as part of their regularly assigned tasks, which have been otherwise budgeted.) Thus defined, a body such as the Council of Computerized Library Networks (CCLN), in the United States, is in a borderline position as a network, despite the fact that it consists of the representatives of a number of library consortia, regional groups, and actual library networks, and despite the fact that it provides its members with means for the identification of common problems in the development and operation of library networks, as well as assistance to its members in finding coordinated solutions to their problems. It barely qualifies as a network because it does not appear to function as such. It apparently has no "life" of its own on an on-going basis. It does not itself, under its own name, even intermittently, engage in coordinative information resource sharing.

It is of interest to note here that the term network appears to have first become generally known to the public, and is still probably best known in popular parlance, in connection with what are called radio and TV networks, such as the NBC, the CBC, the BBC, etc. And this is so despite the fact that the official names of the entities in question seldom include the word "network". Rather, it is the word "system" which is most commonly employed. In view of the virtual synonymity of these two terms in the context of this paper, they are used almost interchangeably herein. It is conceded, however, that in other contexts, a "network" is regarded as a particular type of "system".

NON-PRINT MEDIA NETWORKS

As in the case of the term "network", the terms "national network" and "international network" are also used loosely herein, to refer to a number of arrangements which tend to vary greatly in the nature and degree of their "nationalness" or their "internationality". Included under these rubrics would be such diverse organizational forms as entities which operate "nation-wide" and link the various installations of a given firm found within the confines of a particular country, and entities which operate internationally and link facilities which are scattered throughout the world. As an example of the latter type, one might cite the global network owned by IBM and used largely for its own internal purposes. Exemplifying another type is AVLINE, a subset of MEDLINE. Both are national networks which are owned by the United States government and operated on its behalf, but which provide "outputs" to individual and group users both throughout the United States and in many other countries. They also now accept "inputs", by contractual as well as informal agreements with medical information systems, both private and governmental, from several foreign countries, a service which formerly covered only American publications. Even more "international" would be a network currently being established by UNESCO, one which is to provide information services to educational institutions in UNESCO Member nations concerning items which are of both an educational and an audio-visual, i.e., NPM, nature.

The term "print medium" is here intended to refer to materials, documents, publications, and the like, in which the communication symbols and characters employed are the letters of an alphabet and/or the digits of a numbering system. The letters may be in "script" or "printed" form, or both, and may be monochromatic or polychromatic in nature. The characters may be produced/reproduced in one or more copies, either by hand or by some device (e.g., printing press, typewriter, xerox copier, etc.), and the characters may be recorded and/or presented on some type of paper, by physical and/or mechanical means (e.g., carbon inks which dry on paper) rather than by chemical action. Also included as part of this medium are the maps and pictures, etc., which are printed on paper or similar materials by mechanical means.

The "non-print media (NPM)" are here deemed to comprise all the available means for the storage, the recording, and the communication of information other than those means set forth above under the rubric of the "print medium". With some exceptions, such as microforms, the NPM are comprised of materials whose meaning is intended to be conveyed/transmitted primarily without the use of printed/written characters. In addition, most NPM materials require some type of display device to enable humans to sense/perceive their contents, whereas most examples of the print medium do not have this requirement. In the case of most microforms, though their content is commonly recorded in the form of letters and numbers, and though their meaning is usually extracted by users from "printed words", they are here assigned to the NPM category, in view of the fact that they tend to be recorded photographically

on other than paper materials, and in view of the fact that they require some sort of display device, such as a "reader", in order for their meaning to be extracted.

The NPM are commonly referred to as the "audio-visual" media, i.e., the "audio" and/or "visual" media, to distinguish them from the print medium, which, of course, is in reality as much a "visual" medium as any of the so-called NPM. More real than the foregoing nominal distinction, however, is the one based upon the notion that audio-visual/NPM materials are usually deemed to include the "contents" of "live" "real time" events and experiences, such as "on the spot" radio and television broadcasts, even though such broadcasts may not necessarily be subsequently or concurrently recorded anywhere, whereas print materials are never "live" in quite the same sense.

Despite the foregoing distinctions, the increasingly rapid merging of the print medium with the NPM; the integration of their technologies; and the transference of the contents of print medium items to those of the NPM and vice versa (e.g., the reproduction of pages of books on videodiscs, and the reproduction of the contents of slide-tape sets in "comic book"-type publications, where the audio content of the tapes is found in the balloons of the cartoons), have rendered it virtually impossible to maintain a clear-cut distinction between them. Nevertheless, and however temporarily, the networks which deal solely with the print medium and those which deal with the NPM still differ in several crucial respects. As will be pointed out in more detail subsequently, these differences pertain in the case of NPM networks which deal exclusively with exchanges of information <u>about</u> NPM materials as well as those which deal with NPM materials themselves. And, in the case of networks which are very broadly inclusive in nature, in that they involve combinations of the print and non-print media, they, too, differ extensively from those which are only print in character. Generally, as might be expected, all of these network differences relate principally to the physical characteristics of NPM materials versus those of print materials, as well as to the respective uses to which the materials are put.

A further distinction is here made among NPM networks themselves, a distinction based on whether or not the networks are "electronic" in character. Electronic NPM networks involve the transmission of shared/exchanged information by means of telecommunications facilities/systems, rather than by the physical transfer of the NPM informative materials <u>per se</u> (e.g., educational motion picture films). They also permit the simultaneous sharing and remote use of hardware, software, and data bases. In electronic networks, too, the information must be fed in and taken out in forms prescribed and directed by the systems, a characteristic which has an important bearing upon the functional capabilities of any given NPM network. In this paper, electronic media networks are also deemed to include those in which the mechanisms/techno-

logical devices used have sensory capabilities, rarely possessed by humans, relating to electromagnetic waves (e.g., the ability to react to magnetic waves, radio waves, and the like). "Non-electronic" or "manual" NPM networks, on the other hand, are those in which the transference of the NPM items in question is accomplished by the actual physical re-location of the items, rather than by their reproduction elsewhere, possibly in a different media format.

A further distinction is here drawn between "mass media" NPM networks which are designed to serve general audiences indiscriminately, such as those involved in radio and television "open broadcasting", and those intended to serve differentiated/discriminate individual and/or group audiences/users. The former type of network, for the most part, transmits the content/subject-matter that is to be conveyed primarily to interest and/or entertain mass audiences, rather than to inform/enlighten them. They also tend to provide only "one way" (uni-directional) or non-interactive services, i.e., services with little provision for immediate and direct feedback from their audiences. Such networks are not of direct concern to this paper. "Discriminate" NPM networks, on the other hand, are those which are primarily intended to be used by specific individuals, groups, or institutions, with their services and functions being at least partially attuned to the individual informational needs and interests of the particular users. They accordingly tend in some measure to be interactive and bi-directional or multi-directional in nature. They are also likely to transmit their shared information via ostensibly "private" and/or "closed circuit" information/telecommunication systems. It is these discriminate NPM networks on which this paper will focus. However, to the extent that the content of the information which is conveyed by the discriminate NPM networks is carried by telecommunication systems which tend to be owned, controlled, and/or operated by indiscriminate mass media systems, to that extent peripheral mention of the mass media networks will, of course, be made.

Assumptions

The content of the paper is predicated upon two basic assumptions. The first is that electronic NPM information systems will increasingly be necessary for the fast, accurate, and efficient control of the complicated and interdependent processes of our high-technology civilization. The second assumption is that national- and international-level NPM networks will henceforth continuously have a considerable influence on regional, state/provincial, and local information systems and agencies, as well as on the whole realm of information science. In particular, it is anticipated that upper-level NPM networks will affect these various organizational forms with respect to their methods of handling NPM information, their planning of automated NPM information systems, and the creation and operation of lower-level NPM networks.

Scope and Intended Utility

Time and space limitations, as well as the "state of the art" in the field and the extent of the knowledge of the author, preclude a full treatment of all the facets of the topic which are deserving of coverage. The writer has accordingly determined, after having provided the foregoing basic introduction, to first broach the range of sub-topics which appear to warrant investigation and/or detailed treatment, and then to touch upon only certain aspects of a few of the subordinate areas, i.e., those which, in his view, are most clearly in need of explication and/or exemplification. The spectrum of sub-topics presumably worthy of being adequately addressed include:

1) The state of the art of national and/or international NPM networking, including both a description of the types of extant operational, prototype, and planned national and/or international networks (N/I NPM nets), and a description of the extent to which other types of currently existing or planned high-level information systems also undertake the exchange of NPM-involved information;

2) The principal objectives, functions, and services of extant and proposed N/I NPM nets;

3) The additional major similarities and differences which pertain between such networks and their print counterparts;

4) The apparent trends in the development of N/I NPM nets and the barriers which militate against their development and/or success;

5) The crucial NPM and other resource accessibility problems which would appear to be rendered more readily tractable than hitherto by the development of effective N/I NPM nets;

6) The presumably "solved" national and/or international print network problems which "re-surface" when NPM or combinations of print and NPM networking is attempted;

7) The nature of new problems and issues engendered for information system users, and for information scientists, as a result of the lack of, and/or the imperfect development of, appropriate N/I NPM nets, as well as the new problems and issues which arise from the effective functioning of such networks;

8) The probable potentialities of N/I NPM nets for the relatively immediate future, including their anticipated impact, both on the highly industrialized nations of the world and on the developing "Third World" countries;

9) The presumed advantages to be gained and the pitfalls to be

avoided in their further development and spread; and

iii) The summarization of the "add-on" value which such NPM networks appear to bestow, on balance, to information systems, as well as the value which the study of such NPM networks presumably has to students of information science.

Among the above-noted sub-topics, there appear to be three, the treatment of which, conjointly, would seem to best permit the reader to perceive the essence or the "flavour" of N/I NPM nets. They are: the similarities and differences which pertain between these networks and print materials networks; the problems and issues which arise in the development of N/I NPM nets; and examples of operational and planned N/I NPM nets. The remaining sections of the paper will concentrate on these three themes. Hopefully, the paper will thus provide its audience with a deeper understanding of N/I NPM nets and with new insights into the extent to which these networks may assist in the achievement of the presumed ultimate objectives of all information networking - the more effective satisfaction of user information needs, through the sharing of services and resources. In particular, it will seek to make at least partly discernible the manner and the degree to which such networks may do so, independently of other networks, as complements to them, or as integral parts thereof.

To maximize its impact, the tenor of the paper has been deliberately designed to attract and focus the reader's attention on a very personal basis. The reader is especially invited to relate the contents of the paper to his/her own particular activities and professional environment, and to assess the probable costs and benefits to be derived from his possible initial or continued involvement in the use of NPM networks. He is encouraged to contemplate the political and economic considerations and implications, both for himself and for all others immediately involved in participation in such networks. In the event of the need for the inception and maintenance of an appropriate new network, he is asked to ponder the role, if any, which he might effectively play in the planned enterprise.

SOME CURRENT SIMILARITIES AND DIFFERENCES BETWEEN PRINT AND NPM NETWORKS, REGARDLESS OF THE GEOGRAPHICAL DISPERSION OF THEIR PARTICIPANTS - NPM INFORMATION NETWORK DESIGN CONSIDERATIONS

The design and operation of networks which exchange or share information in print form solely about NPM need not differ radically from the comparable features of other types of information networks, for example, those which involve the exchange of bibliographic information. Rather, it is the networks engaged in the sharing/exchange of information in actual NPM formats, which involve very considerable design differences from those exclusively engaged in print medium information exchanges. Among the design considerations

which commonly need to be taken into explicit account with respect to DFR networks but which may generally be disregarded in the case of networks engaged in exchange of print information are the following:

1) The nature of the individual and group users of the information in question - their information choices, needs, and interests, and their experiential backgrounds, etc.;

2) The satisfaction of the end-users' changing information needs by means of as direct access as possible to the required information, while also meeting their needs by means of appropriate engagements on the part of human intermediaries;

3) The particular characteristics of the DFR media being used by or created in the information processing system in question, such as its "browsability", with due regard to whether the processing involves the creation, collection, storage, organization, retrieval, or "managing" of that information;

4) The simultaneous provision of either individual or group information services, or both;

5) The simultaneous provision, if need be, of recorded or live interactive, multi-directional information services and services which are basically non-DFR in character, as well as services to particular users which are on occasion either interactive or non-interactive;

6) The provision of services which, in some instances, may be partly or almost completely manual, partly or completely computerized, and if computerized, "on-line" or batch processed in nature; and

7) The simultaneous provision of services intended primarily for "in-house", internal, network system operators, and services for other intermediate and end-users who are in one or more senses "external" to the system.

PROBLEMS WHICH ARISE WHEN ATTEMPTS ARE MADE TO ESTABLISH AND OPERATE DFR NETWORKS - THE BARRIERS TO DFR NETWORK DEVELOPMENT

In general, the hurdles which must be surmounted in the establishment and/or viable operation of DFR networks include not only those which tend to place a brake upon the effective functioning of print-oriented networks, but also other numerous, even more onerous impediments as well. The cultural, political, economic, personal, professional, and technical problems, and the issues of information privacy and freedom of information access, all inherent in the formation and working of print networks, seem to appear in the same and other guises but in exacerbated form in the DFR

systems. However, at least in the broader dimension, virtually all of the problems and issues which surround the NATIS activities are encountered at the local level and in some ways difficult to deal with when occurred at the national level, and they become even more formidable at the international level.

Although NATIS networking problems tend to be closely related to one another, and hence are likely to affect each other either adversely or beneficially, they can, for purposes of analysis, be classified into the various principal types indicated below. It should be noted that the order in which the following problems are presented is not intended to be indicative of the seriousness or the severity of the problems nor of the desirability or fundamentality of the issues at stake.

Technological Problems and Issues

Many of the problems which occur with respect to NATIS network activities, particularly at the national and international levels, revolve around several related issues of technological development, viz:

1) The need for various types of standards to be set and enforced, without stifling innovation and progress;

2) The need for the adoption of new technological developments and new standards and the avoidance of obsolescence, with minimal disruptions to current functioning and to personnel satisfactions; and

3) The need for the elimination of the costs incurred in adopting current practices and the like to new and/or revised standards.

As may be gathered from the preceding statement, standardization problems have especially heavily upon the NATIS networking issues. This situation is probably most readily demonstrable in connection with bibliographically-related matters, such as the lack of standardization of "holdings" and "loaning" statements, and standardized citations for each of the various types of NATIS documents with by the networks. An example in point is the efforts being made by many countries to gain official or unofficial acceptance of the United States Library of Congress MARC (machine-readable cataloging) format nationally and internationally for the storing and retrieval of NATIS materials. Similar efforts are being made on behalf of the recently published International Federation of Library Associations' Standards for the Description of Non-Book Materials. In both instances acceptance has been spotty and, for the most part, incomplete, despite the fact that the full acceptance of either one could greatly alleviate the attendant problems stemming from the absence of universal standardization. In the case of the NASA system, for example, although there has been fairly widespread local and national acceptance of to among the various

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result of the fact that the vendors, in turn, each have their individual communication languages, search features, and means for having new data entered on their tapes, etc. Consequently, even within the larger existing NPM networks, there remains a need for standardized, yet specialized automated communication systems designed to provide on- and off-line communication for both bibliographic/mediagraphic data and for exchanges of different types of data services between the various levels within the networks, e.g., between the local and regional nodes (centers) and/or between the regional and national nodes.

Complicating the situation still further is the fact that NPM data bases commonly require far more "fields" or data elements (which identify authors, producers, sources, etc.) than do print data bases. Additionally, each NPM data base is likely to differ from others both in the number and nature of data elements which it has available for searching purposes and in the manner in which its "records" may be searched.

To add to the foregoing standardization problems, as in the case of other types of networks, there is an absence, in NPM networking, too, of information security standards. It is, in varying degrees, more difficult to obtain agreement and to implement and enforce standards and regulations with regard to the NPM, than it is with regard to the print medium, in such matters as: unauthorized access and retrieval of NPM information; unauthorized input of data; and unauthorized changes in data bases. These weaknesses in NPM systems, of course, have many human rights implications.

Numerous other technological impediments stand in the way of efficient and economical NPM networking. Some NPM networks, for example, especially those which still employ the broadcast media for transmission purposes, are essentially one-way entities, even though two-way communication is a virtual prerequisite to successful full-scale NPM network operation. The use of only one-way transmission is understandable, however, in view of the fact that, with some exceptions, communication involving materials couched in actual NPM formats is far more complex and costly than the provision of comparable features in a system involving only printed content.

Furthermore, many existing individual NPM resource facilities (including some which are quite automated, such as film booking and reservation systems), which could conceivably seek to become NPM network participants, do not readily lend themselves to being "tied-in", for networking purposes, to other information systems or entities. Additionally, they tend not to be susceptible to being tied-in to systems involving other types of media than those with which they already deal. The sound preplanning necessary for such tie-lines to be readily possible seldom occurs anywhere.

Important technological breakthroughs will have to occur before

access, via electronic networks, to certain NPM materials may be easily accomplished. Not merely for inexperienced lay end-users but also for media-oriented professional information scientist intermediaries as well, important obstacles still effectively frustrate attempts on their part to have, on the basis of the use of appropriate index terms, key words, etc., and other appropriate retrieval procedures, remote electronic access to many types of NPM materials. If, for example, a person at a particular site seeks, in a collection of NPM materials located elsewhere, to find, among the available videotapes and motion picture films, particular "footage" dealing with, say, a crystalline substance which exhibits a specific combination of colors when examined spectroscopically, and he attempts to do so without having to examine all the films and videotapes on a "foot-by-foot" or "frame-by-frame" basis, then he will, in all probability, be quickly thwarted by the lack of appropriate words to begin the search. For, in the case of many NPM materials, the precise identification of a needed item, through coding, indexing, etc., may require content indicators other than words or numbers, to refer to a variety of static and/or dynamic physical phenomena, including actions, color changes, etc., some of which may not as yet even possess names or have precise words by which they may be identified. The indexing and retrieval of such items involve botclenecks which seriously hinder the full functioning of certain NPM networks. As a result, until all NPM material can be properly indexed and coded for retrieval purposes, remote searching for NPM items will involve what amounts to "full text" searches, which, in the case of large libraries of such NPM materials, might entail an impossibly long and expensive task.

Also, apart from those NPM networks which deal exclusively with bibliographic/mediagraphic content and those which engage only in the "technical processing" of materials, such as the production of union catalogues, etc., NPM networks are almost perforce decentralized or "distributed" networks, rather than the centralized types of system which commonly occurs in the case of print media networks. For, in the NPM type, at each node or point, each member entity is likely to possess only its part of the total network data base, and there may therefore be no central point at which the entire data base exists as a unified whole. While this situation provides for a desirable degree of local autonomy, it compounds data base searching problems both for end-users and for network personnel.

One last impedient to effective NPM networking warrants explication here. In the case of informative items which are couched in the print medium, such as books, they tend to contain a table of contents or a "plan", and/or an index, along with the text. All of these features may be readily scanned or browsed through and surveyed, in order to enable the user to gather preliminary information or to determine whether the "document" warrants further attention. By and in the large, the NPM are not susceptible to browsing or similar procedures, and consequently tend to require,

even more than print materials, the generation of precis and abstracts of their contents, either in print or in other formats. As yet, however, NPM materials are far more likely to lack the latter essential components than are print items. And, unlike the print medium, there are almost no available abstracting and indexing services which deal other than superficially with the content of NPM items.

The afore-mentioned technological barriers to successful and full-blown NPM network services, at any geographical level of operation, by no means comprise the total set of such impediments, but they will presumably serve to demonstrate the fact that problems in the NPM realm differ significantly, in number, quality, and complexity, from those afflicting the print medium. As will be indicated later, although portions of "full service" NPM networks exist, they must be considerably augmented and complemented by further extensive and costly effort, including the occurence of technological breakthroughs, before they will be enabled to provide remote and localized, on- and off-line access, via standardized, flexible retrieval search techniques and strategies, to all of the desired NPM data.

Economic and Legal Problems and Issues

National and international NPM network planners and operators are confronted, like their counterparts in the print field, with a whole gamut of economic, financial, and legal obstacles to their progress. Such stumbling blocks range from broad, almost philosophical problems, such as those stemming from differences in national economic systems and outlooks, to ones of a very specific and practical nature, such as the detection and prevention of the illegal use of national communication facilities. Here, too, the severity and complexity of the problems that are encountered overshadow those affecting the print medium.

First, N/I NPM nets tend to be much more costly to establish and to maintain than their print counterparts. Moreover, as the NPM often comprise new adjuncts to existing facilities and programs, they are, at least for the time being, likely to be perceived, by all but media personnel, as functionally peripheral to the current activities of the entity in question. In like manner, they tend to be the first services to be pared or deleted, in the event of the inevitable budget crunch. Secondly, because many of the NPM items dealt with by networks, at all jurisdictional levels, consist of materials which may be directly used, or easily converted for use, in the mass media, where they might attract large audiences, they are particularly enticing prey to copyright pirates, data base and program thieves, and censors, economic chauvinists, etc. And, partly for the same reason, they comprise frequent grist for those who are concerned with matters of privacy of information and freedom of information. More so than in the print medium, too, the available technology for the duplication of NPM resources has far

outstripped the dissolution of the legal entanglements involved, as well as the ability of institutions to police the illicit reproduction of such items, including illegal reproduction by NPM members and/or their patrons.

In the case of books, there are seldom problems which arise concerning copyright ownership, royalties, and the like, for other than the authors and publishers directly concerned. There is almost never a question of "residual rights" for the printers of a book. But in the case of the NPM, there is commonly the involvement of a variety of creative and technical talents, at times highly unionized personnel, such as performers, programmers, etc., as well as others, such as men on the street or children in classrooms, who, as a result of participation in, say, an educational television program, may lay claim to various residual rights, for profit and/or non-profit uses of the NPM item in question. In some cases, the determination as to which individuals or groups are entitled to such compensation, under the given circumstances, may be even more onerous and expensive than all the other aspects of the exchange of the information, particularly when more than one legal jurisdiction (e.g., more than one nation) is involved. And even when such determinations can be made, it is difficult to keep track of them, especially when there are differences as to the amount of the charges incurred, as measured by the various handlers and receivers of the information.

There are also numerous financial and other complications which arise, when attempts are made on the part of nations to reach and implement international "free-flow" agreements with respect to the physical sharing/exchange of NPM resources. The cost and time problems inherent in the "mechanics" of such agreements, when coupled with ones of a political and legal nature, may weigh so heavily on NPM networks as to successfully hinder, or even prevent, what are generally agreed should be free exchanges. There are, for example, comparatively high shipment costs involved for many NPM items, as well as frequent shipping delays, especially where the materials in question have to cross international boundaries. Also, as a result of their potentialities for commercial exploitation in theatres, etc., NPM items are far more likely than print ones to be subject to customs duties, and to require, from customs inspectors, indications as to the usages to which the materials are to be put - commercial, educational, non-profit, etc. Then too, the borrowing, renting, and using of many types of NPM materials by the patrons of NPM networks tend to be more difficult than borrowing, etc., of print materials. This is in part due to the generally higher costs of most major NPM items (e.g., videotapes and 16 mm films), as compared with the cost of most bound books. This situation, in turn, commonly results in member institutions having only a single copy of NPM items, which they are understandably loath to lend to other institutions. This is especially true in the case of those NPM items whose contents cannot be readily transmitted electronically to "outside" or external would-be users.

NON-PRINT MEDIA NETWORKS

The foregoing situation is further encumbered by the fact that many NPM network member institutions become engaged in the sharing of their non-print materials only very gradually, as an adjunct of their sharing of print materials. This results, in turn, in some institutions permitting the sharing of restricted portions of their NPM holdings (such as their slides, perhaps because they are all catalogued), but not other portions thereof. Hence, the logistics involved in determining what is exchangeable or borrowable, and what is to be charged, if anything, for such exchanged materials, can become quite complicated for network members. This is particularly so when accounts must be kept with regard to how often certain materials have been used and reused by the patrons of other members of the network. Moreover, network members currently find it difficult to maintain readily updatable inventories of the NPM holdings of fellow members. Yet they also find it difficult to agree to establish, and pay the costs involved in the operation of a clearing house that might ease the task of maintaining a single inventory.

In addition to the above considerations, problems are also encountered in connection with efforts made by NPM network personnel to be aware of and keep track of new commercially produced materials, as there are innumerable local producers, as well as the national ones, with considerable resultant duplication of effort and resources. Such duplication may involve uneconomic implications for NPM material production and distribution, and may ultimately be reflected in unnecessarily high costs for NPM materials. In a number of countries there is, moreover, another form of duplication of effort, and although this situation may have some benefits, it makes for overly expensive networking services or makes difficult the implementation of overlapping network plans. In Canada, for example, there are afoot NPM network plans which are, in varying degrees, competing and overlapping, such as those being put forward by the National Library, the National Film Board, the Canada Institute of Scientific and Technical Information (CISTI), and the CBC and CTV networks. Not all of the above networks are being planned cooperatively, and to whatever extent they are already operational, they are not working in full cooperation, one with the other.

The foregoing many problems are compounded, almost everywhere, by the fact that even more so than in the case of print networks, the number of NPM information handlers, those who comprise the links in the chain joining information producers and information users via NPM networks, is constantly increasing. Each additional human link tends to increase the costs incurred. Besides the producers of information, the indexers and abstracters, the vendors, the information brokers, and the telecommunications personnel involved in print networks, in their NPM counterparts there are often still other echelons of personnel required, in the form of media technologists and high-level subject-matter specialists (who are needed, for example, to provide content indicators for such

materials as films and videotapes), because conventional indexers and abstracters tend to be unable to cope satisfactory with other than the printed word.

Because NPM network members, such as non-profit organizations, government-owned facilities, quasi-public "crown corporations", and the like, vary greatly in their status vis à vis their respective governmental agencies, with each type of member having its own set of subsidies, tax exemptions, tax to be paid, etc., the relationship among members tends to be encumbered, and, in turn, the cost of network operation is once again increased.

Probably more serious, financially, is the fact that NPM networks, at any jurisdictional level, entail heavy capital equipment costs, ones which generally do not have to be borne by print medium networks. In addition, the costs of the NPM items of equipment, and of the software used in them, not only tend to be rising but are rising considerably more rapidly than the cost of print materials, in part because the latter do not usually require importation, whereas high-technology items often do.

Finally, and incidentally, an important economic problem has arisen recently for many commercial NPM producers as a result of the ease with which the reproduction of some NPM materials may be accomplished and also as a concomitant of the emergence of NPM networks. As networks increasingly share those NPM items which can be electronically transmitted to member institutions (where those items are perhaps reproduced), NPM network operation has, in some instances, markedly and adversely affected the sale of the more expensive types of NPM items. Some producers, in consequence, claim that the further development of NPM networks will inevitably result in a decline in the production of high quality expensive NPM items, if not other NPM items as well. The demise of the latter commercial NPM resource producers might, of course, curtail the number of purchasable NPM materials, and hence might, theoretically, leave NPM networks without new materials to be exchanged. This prospect, however, is not as yet one of evident concern to NPM network personnel.

Despite the many serious financial and legal hazards and hurdles outlined above, N/I NPM nets are being brought into viable economic existence. Indeed, many are established largely for financial reasons. NPM networks are increasingly deemed by their members to comprise a valuable means for enhancing the benefits derivable from their respective budgets, and for decreasing unnecessary duplication of effort among participants. The overall financial and personnel-time savings apparently obtainable from networking appear to more than offset the great effort required to overcome the piled-on-pile of existing barriers.

Personnel and Other Problems and Issues

For many of the personnel involved in the inception and subsequent functioning of N/I NPM nets, at least two modifications of their professional life-style are likely to be required. These include specialist-level participation in an unaccustomed form of cooperative endeavour, and the acquisition and use of knowledge and skills in the area of audio-visual or non-print media, particularly the newer electronic media. Insofar as resistance to basic changes in one's behaviour patterns is almost universal, the reluctance of librarians and computer scientists, who comprise the great majority of NPM network personnel, to undertake, wholeheartedly, the operation of NPM networks is understandable. For not only are they largely unfamiliar with networks and networking but the characteristics, similarities and differences, and respective advantages and disadvantages of the various NPM are also quite likely to be foreign to them. As the increasingly intellectual and professional character of the tasks being newly performed by automated systems which involve technological devices becomes ever-more apparent to them, psychological problems are almost bound to arise within their ranks, in the form of man-machine conflicts. Another potential source of deep conflict is inherent in the need for these people to work at the local, national, and perhaps even at the international level in close cooperation with colleagues who are different from them in their professional outlook and training. The fact that appropriate combined NPM-library-computer and information science talent is bound to be required in NPM networking, not only at the central network facility but also at the local nodes, is likely to go unrecognized by nearly all concerned, and is almost certain to engender further problems.

On a more mundane level, the newness of NPM networks and the probable inexperience of their initiators and operators will probably produce difficulties in such aspects of their work as: predetermining and analyzing the man hours required to do a task, and estimating the amount of computer time, if any, required; determining who can best do a given task, and where, when, how, etc.; assessing the anticipated costs of required equipment; hooking up said equipment; etc. Additionally, the personnel of member network institutions probably also lack the training to engage satisfactorily in the assessment of the quality of NPM materials, as well as the quality of the hardware which can "play" or display those materials. Their training and background are furthermore likely to be such that they would find it difficult, at least at first, to become aware of the existence of relevant new materials, and/or to be knowledgeable about other current developments in the NPM field, both of which phenomena could affect either the contents of what is dealt with by their network or the actual operation of the network itself. By the same token, they are probably unaware of the extent of the consensus, if any, which may exist concerning standards of various kinds relating to NPM materials which might affect the quality of the network's functioning.

Besides the problems afflicting the operational staffs of NPM networks, there is another order of problem in which end-users may be involved. These are likely to be most acute in the cast of NPM networks which are planned to involve the staffs of educational institutions, particularly the faculty members of institutions of higher learning. For at the latter level, the instructors have, far more so than is the case with staff at other educational levels, tended to restrict their use of NPM resources to those of their own making. Because at all educational levels instructor and administrator inertia is known to abound, considerable modification of attitudes to NPM media usage would be prerequisite to the full participation, as network users, of such educational personnel.

Unfortunately, too, network member institutions have seldom found it possible, in advance of their attempted inception of a NPM network, to mount the kind of extensive in-service training program necessary for the success of such an enterprise. Presumably such programs would have to include short courses and/or workshops for network operators and, in the case of educational institutions, for their instructors and administrators as well. Prospective NPM network members also commonly fail to conduct appropriate public relations campaigns among network personnel, institutional administrators, and other potential end-users, prior to, during, and following the establishment of a network. This failure tends to accentuate the problems already set forth above.

Among the problems which arise to plague would-be and current NPM network employees and end-users is one which stems from the fact that, in the absence of adequate indexes and abstracts for most NPM materials, and as a result of the demands of major classes of users, namely, school teachers and students, it is currently almost a requirement that NPM resources be accompanied by descriptive, and/or evaluative, and/or review materials. These materials are now commonly deemed to comprise a basic part of the bibliographic/mediagraphic data required to identify NPM items. The provision of this information, for the various specific intended audiences of the materials, usually requires the services of qualified subject-matter assessors and educators (incidentally involving the presence of still another layer of personnel), and as a result, the amount and quality of the work entailed, the costs incurred, and the problems of professional interrelationships which occur are all augmented.

Almost ironically, one problem encountered by prospective NPM network members is an almost chronic lack of several types of information which are virtually essential to the effective pursuit of their networking goal. There is an evident dirth of information about state/provincial or national institutions which might, like their own institution, be interested in the formation of new NPM networks. There is, as well, a paucity of information concerning already planned but not as yet functional NPM networks, and also about operational NPM networks which are fragmentary and hence in

need of being "filled out". Similarly, there are gaps in the information available and necessary for the determination of how local, provincial, regional, and national NPM networks might or should fit, as nodes, into overall information services.

It may be concluded, then, that NPM networks appear to encounter serious difficulties in securing appropriate personnel and in obtaining and dealing with the kinds of comprehensive information which they require in order to engage in the effective exchange/sharing of NPM items. That viable NPM networks have nevertheless come into existence, at all of the various levels, attests to the fact that, at least in part, the foregoing problems have been attenuated as a result of the concerted efforts of the participants of network planning and operation.

The various difficulties facing prospective NPM network member institutions located in the developing Third World countries comprise problems of another whole order of magnitude. For the most part, each such country does not have sufficient means at hand even to conduct the type of survey needed to determine the location, number, and other mediagraphic information concerning NPM items available within the country, in order to render possible the building of either a manual or a computerized data base covering its national holdings. The developing countries are consequently deeply concerned regarding what they perceive as a growing gap or distance between the "information rich" and the "information poor" nations, a gap which they feel is being even further widened by the successful development of national and international NPM networks which embrace in scope only highly industrialized and relatively wealthy nations. Hence, having almost ridded themselves of the shackles of political and economic imperialism, some of these nations are now having concerns regarding the possibility of their being encompassed by information and cultural imperialism. These fears on the part of some Third World nations appear in modified form in some of the industrialized nations as well. To at least some observers therein, the new NPM networks, along with their print counterparts, may become instruments of unprecedented power, and this power, in turn, is likely to rest in the hands of employers, administrators, and specialists, rather than in the hands of the general citizenry. To such critics, this situation seems likely to worsen the divisions in society between the managerial/expert class, which understands and controls the networks, and all other classes. These critics, like the inhabitants of the developing nations, also tend to perceive an exacerbation of the divisions among the well-to-do, highly industrialized nations and the Third World countries.

EXAMPLES OF N/I NPM NETS

Despite the newness of international networking in the NPM area, a number of operational systems already exist and several

more are in the planning stage. There are, however, none that are known to the author which are both in operation and which have been established under some form of international aegis. UNESCO, for example, has at least one international NFM network being planned, but none is operational at the time of writing. Few details have been made available as yet by UNESCO concerning their plans. Hence, the known extant NFM networks operating at the international level are all basically national entities which, in varying degrees, have extended their scope to include participation in the form of inputs and/or outputs to individuals, groups, institutions, or political jurisdictions, in one or more foreign countries. Similarly, many of the national-level NFM networks were originally state/provincial or even local-level entities which expanded the scope of their operations to give these operations a nation-wide coverage.

In the developed Western nations, existing N/I NFM nets tend to complement and parallel each other, and, to an extent, also to duplicate and compete with each other. Such cooperation as exists is on an informal basis, without the entities concerned being joined together in a single official cohesive network. Each entity may, in its own way and format, provide direct and indirect services to national, state/provincial, and local units within its system, or beyond its system, as well as to qualified individuals. Almost all of these networks are parts or subsets of networks which deal with a variety of types of formats for informational materials. In some, the NFM portion of the network serves primarily as a "back-up" service for the personnel of the system, e.g., for the reference librarians. In these cases, the NFM portions of the network tend to supplement or complement the basically print media network service, by providing members and/or patrons with presumably more rapid, more complete, and/or more efficient services than could otherwise be supplied. They also offer information seekers improved access to NFM and other materials. In many countries among the developed nations, these services are provided by specialized information centers which operate international-level and/or national-level information retrieval systems, selective dissemination of information services, and information analysis departments, etc. Most of these entities are geared to "single topic" and "single mission" operations. Their responsibilities include the creation and publication of reports, audio-visual materials, abstracts, indexes, data bases, etc., dealing with, or involving print and non-print materials. As may be anticipated, they tend to serve very specialized professional and/or technical audiences.

In English-speaking countries, the NFM networks which have attracted the greatest interest on the part of professional specialists are those which are centered in the United States, Canada, and the United Kingdom. The examples to be cited here are all taken from these three countries. The reader is reminded that, as was discussed earlier, standard radio and television broadcast networks will be here mentioned only peripherally, although it is recognized that these entities, in a few of their activities, such as in their

school broadcasts, closely approach the types of agencies and activities which are dealt with herein.

In the United States, several national governmental agencies, such as the National Library of Medicine, the Library of Congress, the Technical Information System (TIS), formerly the National Agricultural Library of the U.S. Dept. of Agriculture, and the National Institute of Education (NIE), each has its own systems or networks which are capable of supplying large numbers of users, both internationally and across the nation, with a variety of print and non-print information services. Probably best known among these is the ERIC (Educational Resources Information Center) system, initiated and supported by the NIE. Among the various ERIC subcenters which deal with particular aspects of education, that called the ERIC Center or Clearinghouse on Information Resources, at Syracuse University, provides an integrated print and non-print information service which deals with the whole area of information resources in education. In fact, the information resources dealt with extend beyond the field of education, into aspects of the social sciences, the natural sciences, and the humanities. The Clearinghouse inputs which are eventually output in the form of computer tapes, print materials, and full text versions on microfiche, comprise portions of the total ERIC data base. The tapes are available on an on-line and off-line basis, both nationally and internationally. Inputs are welcomed from institutions and individuals from several foreign English-speaking nations.

Also supported by the U.S. national government is NICEM (National Information Center for Educational Media), whose data base contains records concerning virtually all of the commercially and freely available United States-produced educational NFM materials. In the NICEM system, each medium (e.g., film strips) is covered in separately published volumes, which are regularly updated. The contents of these volumes (not the items referred to therein) are now also available on-line, through commercial data base vendors. Hence, insofar as the vendors in question provide their services internationally, the data are available internationally. It should be noted that the NICEM system does not indicate where and how the materials in question might be borrowed or rented, or where copies of the items are located. A counterpart of NICEM is found in few other countries, although in Canada and elsewhere, rather fragmented steps are being taken to establish such a system.

Probably the next best known American-centered, international-level, combination print and non-print network is AVLINE, which, as previously mentioned, is a subset of the National Library of Medicine's MEDLINE. The latter is a specialized medical information network within which AVLINE comprises a bank of information dealing with existing audio-visual items in the medical field. AVLINE contains information, in print form, about the bibliographic/mediagraphic details, such as the title, producer, date of production

media format used, etc., concerning the audio-visual items in question. However, a sub-subset of the system can provide information concerning the conditions of availability of said items, as well as information regarding the persons or institutions to be contacted, in the event that the items themselves are desired. Another sub-subset of AVLINE provides very extended abstracts of the contents of the listed items. Like its parent, MEDLINE, it is available only to qualified health professionals and related personnel, who have access to a computer terminal which may be hooked up to the network. Qualified individuals may also receive AVLINE service via mail or via verified telephone calls.

The U.S. Dept. of Agriculture's TIS is building a similar network to that of MEDLINE in the agricultural field. Its services already include a Regional Document Delivery Service, which provides for the actual distribution of audio-visual items, as well as copies of print materials, in the food and agriculture fields.

The prospective members of the international MARC network, which is being established by the U.S. Library of Congress, include various national agencies which are jointly working toward the goal of universal bibliographic/multigraphic control, through the exchange of machine readable tapes which contain the cataloguing data for their respective country's "imprints" and through on-line access to these tapes. A study of the proposed MARC international network has been completed, and the design of a UNIMARC format, which standardizes content designators for international exchanges, has been completed. In its present form, the UNIMARC format does not, as yet, include an agreed-upon set of content and media format designators for all NFM materials. However, it is intended that NFM materials will eventually be included in the UNIMARC system.

Also provided by the U.S. government is a network operated by the National Referral Center for Science and Technology. This agency does not directly supply end-users with either NFM items or information about such items. Rather, it acts as a central switching and referral center which connects users with sources of information. Both print and non-print materials are commonly held on file at the information sources referred to by the Center.

Among the non-governmental NFM information networks whose products are distributed internationally is the one that is operated by the New York Times newspaper. Its Information Bank, which contains abstracts of the contents of articles of general interest in many of the most important newspapers and magazines in the United States, as well as in the New York Times itself, is now available internationally. It is made available at especially attractive prices, on-line or off-line, to educational institutions. Its contents, like ERIC, can be purchased in microfiche form, so that the purchasers of the microfiche can make use of the indexes provided on-line in order to obtain the text of the abstracts. The Information Bank currently covers only the past few years in its

[illegible] However, an attempt is being made each year to provide retrospective coverage for an additional year.

The additional nationwide audio network services nearly all of [illegible] are available in the United States. One is the 50 member Consortium of University Film Centers. It, in cooperation with the Bantam publishing firm, produces the Educational Film Locator. The Locator, originally available only in print form, is now also available in machine-[illegible] and it is being updated annually. It contains full bibliographic/descriptive and content and ordering information, as well as annotations, analyses, and evaluations. The latter three types of information are based on reviews. The films are listed and indexed under 1000 major subject headings. The film in question tend to be limited to those which have been purchased primarily for university-level educational use.

The other notable commercially-produced example of an ERS network is to be found in the ENCYCLOPEDIA system, which is available from the Encyclopedia Britannica Educational Corporation. It is a computer-generated master index of film footage from the Corporation's vast library of educational films. It is currently available in three formats, hard form, microfiche, and most recently, on-line. The current edition of the book form consists of 12 volumes, totalling over 5,000 pages of computer printout. Each 6" x 4" fiche contains up to 208 pages of computer printout, with the entire set currently consisting of 23 such microfiche. The more than 650,000 bits of film, totalling over 35,000 scenes, are all catalogued and cross-indexed so to content. The individual film footages are indexed and listed by film title, by subject category, by the actions which occur on the film and where they took place. There are 7 different points of entry for access to the system. A description for a scene depicting angry emotion, for example, might be looked up under "Anger" or under "Fighting", in the index. It thus provides a swift means for retrieval of information from dynamic ERS materials, and can be considered as an initial step in the solution of one of the previously noted problems in this particular area. The producers of ENCYCLOPEDIA can provide purchasers with [illegible] of television reproducible quality, of any of the film footage within it.

A similar service is apparently being attempted in the field of [illegible] audio tapes, by the Electric Tape Corporation, located in Totowa, [illegible].

A ERS network which is illustrative of an entity which developed out of the cooperative activities of a large group of widely separated individuals or institutions, and one which provides an integrated information service involving almost the entire gamut of functions included in the information/communication chain, is that provided by the "PLATO" system of the University of Illinois, at Urbana. It is a virtually national network of institutions which make use of the PLATO computer assisted instruction terminals,

many of which are collaborative in nature. These materials are now used in various ways by many thousands of students in many areas of the United States. The interactive graphic displays, some of which are also dynamic, provided by the system are unique and exhibit, in part, on the basis of student choices and needs and also on the basis of student responses to previous graphic displays, etc.

Besides as the inputs and outputs of the foregoing networks can be dealt with by data base systems which operate externally and interactively, the services in question could, at least in part, be made available both externally and interactively. In some instances these services could, of course, be obtained, though possibly not so-fine, by direct application to the network agency which created the data base. Both types of availability do in fact exist in the case of an increasing number of the above-mentioned C.A.I. services.

In Canada, a new Canada project has recently been undertaken, a project which involves a multi-phase plan to provide distinctive graphic/cartographic content of Canadian audio-visual materials. The plan outlines three related EPR projects and is designed to bring about the development of one or more EPR networks. One of the projects is the Information/Distribution System for Canadian Audio-visual Products, sponsored by the National Film Board of Canada. The second, the Standard Catalogue of Canadian-Produced Audio-visual Materials and the third, the PRICE (Processed Content Index System) project, are both being undertaken by the University of Toronto Centre for Research in Librarianship. The latter project, supported by the Ontario Ministry of Education, is designed to develop and produce a multi computer-powered, multi media catalogue in which PRICE descriptions will replace traditional subject headings, and also provide a new method of indexing multi-media materials.

Besides the Canadian scene, the Agency for Instructional Television (AFIT) has, as its official counterparts members, three provincial educational communications agencies, namely, Radio Québec, the Ontario Educational Communications Authority (OECA), and the Alberta Educational Communications Corporation (AECOMM). In addition, the provincial educational communications authority in Saskatchewan, SASKMEDIA, is an unofficial member. Besides providing each other with information regarding their respective products, insofar as is permitted, without involving the agencies in disputes relating to copyrights, etc., these services endeavour to locate interchange their products and to permit the relatively free use of such products within the jurisdictions of each of the members. Thus far, most of the exchanges among the members, and most of the sales of products to each other, have been limited to videotapes. Progress is occurring in the production of a wider catalogue of their videotape holdings. Productions, exchanges, and sales of materials in video EPR formats, such as audio tapes, kits, etc., are rapidly increasing. Recent acquisition of various kinds pro-

duced in relation to the afore-mentioned videotapes and other materials are also being relatively freely exchanged among members.

In the United Kingdom, there has been a recent inception by the British Post Office, which controls and owns most telecommunications facilities, in cooperation with the BBC, of the PRESTEL System (formerly called the Viewdata System). PRESTEL provides a good example of how a combination of the print and non-print media might be used for individualized information services by the employment of currently available technologies, at a cost presumably affordable to a major portion of British citizenry. The system makes use of modified standard home television sets, the telephone system, and a computer-based, multi-media information system. It can be used either in the home or at terminals placed in public places, such as libraries, telephone exchanges, etc. Payment for the service is on the basis of the amount of access time used, and presumably the charges for the use of the system would be added on to the regular telephone service charges. The system, or a modification of it, seems to have great potential for all levels of education and training, particularly in individualized instruction and information retrieval services.

The foregoing selected examples of N/I NPM nets might lead the reader to a misconception concerning the state of the art of NPM networking at the national and international levels, particularly as regards the nature of the great majority of existing and proposed NPM networks. It would perhaps be well, therefore, to indicate that among these networks generally, there is a predominance of those which deal with technical processing services and bibliographic/mediagraphic control systems, rather than those which involve document delivery, booking and reservation systems, reference systems, "on demand" mediagraphics, and information retrieval services based on the content of the "documents" (instead of upon abstracts and indexes thereof). It should perhaps be indicated, as well, that from the point of view of the use of the available technology, NPM network facilities, at all levels, tend to be somewhat more advanced than networks which involve only the print medium. Although seldom available all together in any one NPM network, all of the following technological facilities nevertheless appear to be rapidly entering into use in more and more of these NPM networks. These technological devices and materials include: automated booking and reservation systems; on-line displays of day-to-day, as well as month-to-month network and individual centre statistical summary reports; programs for the processing of statistical tapes; programs for the analysis and maintenance of transaction statistics tapes; automated checking systems used in connection with advance reservations of items, systems which may be searched by title availability, by subject code, and by subject cross-references; equipment for the creation, updating, and generation of camera-ready copy of multi-media catalogues; equipment for the generation of machine readable tapes for computer interfaced typesetting; preview systems which maintain records and evaluations of items

borrowed; and systems for the production of regular reports on items either not returned or returned late, etc. The foregoing automated aides presumably render the burden of NPM networking far more bearable than would otherwise be the case.

CONCLUSION

Almost everywhere among the high technology Western nations, a full vertical and horizontal integration of network components, including NPM components, is occurring as part of an evolutionary, almost revolutionary process. The latter steps are apparently occurring either in parallel with, or prior to, the development, in local, regional, and national networks, of more and better international networks that are also being similarly integrated. It may well be, therefore, that whatever their integrated combination of functions may turn out to be, NPM systems and networks may eventually be conceived of as but a part of a total, individual user-oriented, multi-media integrated network of the future. In time, it should be possible for the user to access both print and non-print computer-based sources via telecommunication networks. And that access will, in all probability, include not only the presently available bibliographic/mediagraphic information regarding the various items in question but also evaluative information concerning the items, as well as their full text.

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